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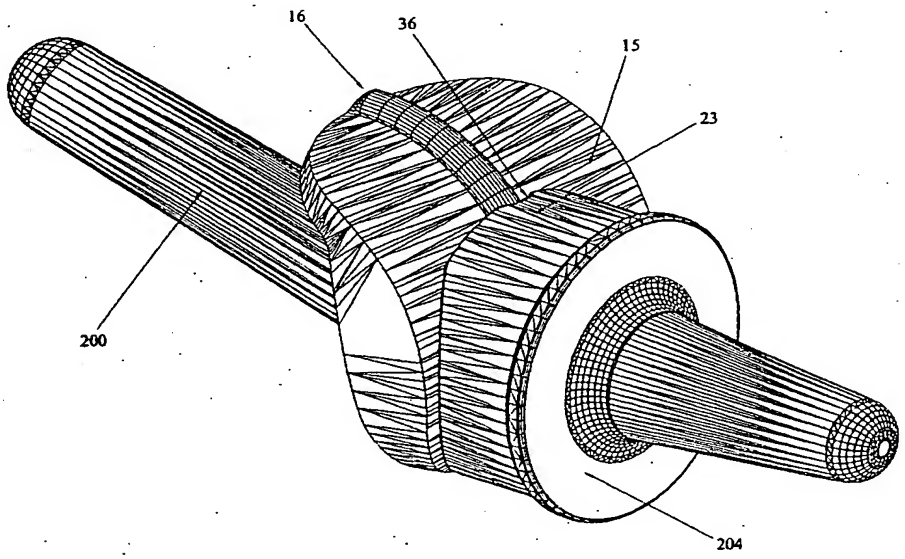
(54) Title: METATARSAL PHALANGEAL IMPLANT DEVICE



(57) Abstract: An implant device for providing an othopaedic joint comprises a metatarsal implant (200) having an articular surface (15) and lateral stability rib (16); a phalangeal implant having a tapered cavity and, therebetween, a sliding miniscus having a lateral stability groove (23) which co-operates with rib (16) and a tapered stem which is housed in the tapered cavity of the phalangeal implant (204). The metatarsal implant is arranged to be secured in a proximal bone and the phalangeal implant is arranged to be secured in a distal bone, whereby the phalangeal component is arranged to rotate and be capable of translational movement relative to the metatarsal implant by virtue of co-operation with the sliding miniscus.

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METATARSAL PHALANGEAL IMPLANT DEVICE

The present invention relates to an implant device. Preferred embodiments relate to an anatomical first metatarsal Phalangeal total implant system which can be used as a press-fit system when the bone interface is coated with any of the recognised osseo-intergratable material such as plasma sprayed commercially pure titanium, vacuum fused CP titanium beads, Hydroxyapatite or other similar Bio-sympatic coatings. The implants could also be used as a cemented system, when the bone interface is coated with titanium nitride using a physical vapour deposition (PVD) process.

The applicant believes that there are currently no similar anatomical first metatarsal Phalangeal implant systems in service which offer the facilities of a sliding and rotating meniscus.

It is an object of the present invention to provide an implant device that may alleviate problems with known implant devices.

According to a first aspect of the invention, there is provided an orthopaedic implant device for providing an orthopaedic joint, the device comprising a first component arranged to be secured relative to, preferably in, a proximal bone and a second component arranged to be secured relative to, preferably in, a distal bone, wherein the second component is arranged to rotate and be capable of translational movement relative to the first component.

Said first component suitably includes first securement means for securing it into a proximal bone. Said first securement means is preferably an elongate member having a first elongate axis. Said first member may be a stem. Said first securement means preferably tapers inwardly on moving towards a free end thereof.

Said first component suitably includes a first cooperation means which may be a head part thereof for cooperation with the proximal bone within which it

may be secured and/or for use in the provision of rotational and/or translational movement.

Said first cooperation means preferably includes a curved, more preferably a part circularly cylindrical, surface for use in the provision of rotational and/or translational movement. Said surface suitably curves through an angle of at least 30°, preferably at least 60°, more preferably at least 90°, especially at least 120°. Said surface suitably curves through an angle of less than 210°, preferably less than 180°, more preferably less than 170°, especially less than 160°.

Where said device includes a first securement means having a first elongate axis as described, said first securement means is preferably fixed relative to said first cooperation means and is more preferably immovably fixed relative thereto. Said first elongate axis preferably defines an angle of a least 3°, preferably at least 5°, more preferably at least 6°, especially about 7° to a radius of the curved, for example cylindrical, surface of said first component, when measured in the direction of the elongate extent of the curved, for example cylindrical, surface. Said angle is suitably less than 20°, preferably less than 15°, more preferably less than 10°, especially less than 8°.

Said first securement means preferably extends from a rear face of said first cooperation means. More preferably, it extends from a main dorsal face of said first cooperation means which main dorsal face is a part, suitably a major part, of said rear face. Said main dorsal face is preferably defined on a chord of the curved, for example circularly cylindrical, surface of the first cooperation means. Said chord suitably subtends an angle of at least 40°, preferably at least 50°, more preferably at least 55° at the centre of the curved, for example circularly cylindrical, surface of the first cooperation means. Said angle is suitably less than 100°, preferably less than 90°, more preferably less than 80°, especially less than 70°. The elongate axis of the first securement means preferably extends substantially centrally from said main dorsal face. Said rear face of said first cooperation means preferably includes an anterior dorsal face which suitably extends laterally to the main

dorsal face, suitably so that it defines a smaller angle with the elongate axis than said chord defines with said elongate axis.

Said first component preferably includes a first guide element which is a component of a guide means for guiding movement, for example translational movement of the second component relative to the first component. Said guide means is preferably arranged to guide relative sliding movement, suitably across the curved surface of the first component (preferably with substantially no component in the direction of the elongate axis of the curved surface). Said first component may include a projecting or recessed member arranged to cooperate with the other one of a projecting or recessed member fixed relative to the second component. Preferably, said first component includes a projecting member for example a circumferentially extending rib.

Said second component (which may be a Phalangeal implant as hereinafter described) preferably includes second securement means, for example a male element for securement into a bone. Said second securement means is preferably provided with a friction reducing surface. Said male element preferably tapers outwardly towards an end of the second component which is nearest the first component in use. Said second component preferably includes a head part which is suitably a flange, extending laterally to an elongate axis of the second securement means. Said second component preferably includes an opening, for example a conical cavity, for receiving an intermediate means which is suitably arranged to connect the first and second components together. A surface of the second component which faces, and preferably contacts, the intermediate means is preferably non-angular in front view. Said surface preferably has an endless, curved, non-angular boundary wall and is, more preferably, ovaloid in shape. The surface is preferably provided with a friction reducing surface.

Said intermediate means preferably includes a male element, for example a conical stem, for engagement in said opening, for example said conical cavity, of said second component. Said male element and said opening are preferably arranged such that, when engaged, said second component can move laterally relative to an elongate axis of the male element of the intermediate

means. Preferably, a face of said intermediate means which suitably has a friction reducing surface makes face-to-face contact with a face of said second component (which suitably also has a friction reducing surface). Said respective faces which make face-to-face contact are preferably substantially planar.

Said intermediate means suitably includes a component of said guide means (when provided) (for example a projecting or recessed member) for guiding movement of the second component relative to the first component. Preferably, said intermediate means includes a recessed member.

Said intermediate means preferably makes face-to-face contact with said curved surface of said first component (when provided) and said intermediate means has a complex curved surface which is substantially complementary to that of said first component. Said complex curved surface is preferably substantially convex in profile when viewed along said guide means associated with said intermediate means; and said curved surface is concave when viewed in a direction which is perpendicular to the extent of said guide means. Said surface of said intermediate means which makes face-to face contact as aforesaid is preferably non-angular, but suitably include a continuously curved outer surface. Said surface is preferably substantial ovaloid in front view.

Said orthopaedic implant device suitably includes five or less, preferably four or less, more preferably three or less elements. Preferably, said device includes only three elements.

According to a second aspect of the invention, there is provided an assembly of an orthopaedic implant device, the device comprising a first component arranged to be secured relative to the proximal bone and a second component arranged to be secured in a distal bone, wherein the first and second components are operatively connected to one another so that the second component is rotatable and capable of translational movement relative to the first component.

According to a third aspect of the invention, there is provided a first component of an orthopaedic implant device per se.

According to a fourth aspect of the invention, there is provided a second component of an orthopaedic implant device per se.

According to a fifth aspect of the invention, there is provided an intermediate means of orthopaedic implant device per se.

According to a sixth aspect of the invention, there is provided a collocation comprising one or a plurality of first components, one or a plurality of second components and, optionally, one or a plurality of intermediate means.

According to a seventh aspect, there is provided a method of providing an orthopaedic joint comprising securing a first component in a proximal bone and securing a second component in a distal bone, wherein the second component is arranged to rotate and be capable of translational movement relative to the first component.

Any feature of any aspect of any invention or embodiment described herein may be combined with any feature of any aspect of any other invention or embodiment described herein.

Further aspects of the invention, will be brought out in the following part of the specification, where the detailed description is for the purpose of fully disclosing the invention without placing limitations thereon. It is also perceived that the efficacy of this type of wear couple will also be relevant to other articular joints in the human body.

Brief Description of the Drawings

Figures 1(a) to (d) are various three-dimensional views of the left small metatarsal implant.

Figures 2(a) to (d) are various three-dimensional views of the small sliding meniscus.

Figure 3 is a three-dimensional view of the small sliding meniscus of Figure 2 illustrating the geometry of the articular profile surface and the lateral stability track.

Figures 4(a) to (d) are various three-dimensional views of the small Phalangeal implant.

Figure 5 is a three-dimensional lateral (side) view of the total implant assembly using the components of figures 1 to 3.

Figure 6 is a three-dimensional lateral cross section of the complete assembly.

Figure 7 is a three-dimensional view of the metatarsal bone interface surfaces.

Figure 8 is a three-dimensional view of the Phalangeal bone interface surfaces.

Figure 9 is a two-dimensional lateral view of the assembly inset in first metatarsal joint (Figure 9(a)), illustrating the perceived re-section of the bone post re-section with implant in-situ (Figure 9(b)).

Figures 10(a) to (c) are two-dimensional lateral views of the assembly inset in the first metatarsal joint illustrating the anatomical range of motion wherein Figure 10(a) illustrates dorsi-flexion, Figure 10(b) illustrates a neutral position and Figure 10(c) illustrates plantar-flexion.

Figure 11 is a two-dimensional lateral view of the assembly illustrating the anatomical disposition of the assembly and showing a 7° anatomical bend.

In general terms, preferred embodiments of the invention consist essentially of three elements:

(a) Anatomical Metatarsal implant (right hand or left hand) in small, medium, large and x-large.

(b) Phalangeal implant – Universal – (i.e. non-anatomic) – in small and medium.

(c) Sliding meniscus – Universal – (i.e. non-anatomic) in small and medium with thickness either 3 mm or 4 mm.

This system may be used as a primary implant or as a revision system where a previous surgical procedure has failed. These implants have been designed to provide a flexible, yet stable system, which will preserve as much original bone stock as possible and in particular but not limited to the sesamoids. The design is also intended to facilitate but not limited to the preservation of essential soft tissue such as the Flexor Hallucis Brevis attachment which then will be used to assist in the balance of the eventual kinematics of the joint. Furthermore, our system has been designed to assist in indications in which there is a painful loss of motion in the first metatarsal Phalangeal joint and where restoration of motion and weight bearing is considered desirable in cases such as rheumatoid arthritis, traumatic arthritis, osteoarthritis and cases of severe hallux rigidus e.g. but not limited to hallux abducto valgus.

Preferred embodiments of the invention may be superior to known devices in the following areas:

(a) Anatomical metatarsals in four sizes in right hand and left handed configuration with a lateral stability rib (small, medium, large and x-large).

(b) Non-anatomical Phalangeal component in two sizes and small and medium.

(c) Non-anatomical sliding meniscus with a complementary lateral stability track in two sizes and two thicknesses small and medium and 3mm and 4mm thickness.

(d) Our components are of a modular design and therefore may be mixed and matched with each other to suit particular anatomical or surgical applications.

(e) Our system has been designed as low profile, and bone preserving. This allows surgeons the possibility of revisions or fusion of the first metatarsal and Phalangeal bones as a last resort.

(f) Our system may either be used as a primary implant or as a revision system, where a previous surgical procedure has failed.

(g) The surface engineering and surface improvement of our wear couples have been developed to provide a particularly low coefficient of friction.

(h) Our lateral stability rib and floating meniscus design provides for a flexible, versatile, low friction wear couple.

Referring now to Figure 1, the metatarsal component has an articular surface with numeral 15 which is a defined concave cylindrical geometry and is equally bisected by the defined concave cylindrical geometry of the lateral stability rib 16. The dorsal face 17 of this implant is angled at 60° to the centre line of the component so as to encourage Dorsiflexion. The posterior profile 18 of this implant is designed so as to preserve the sesamoids 37 (Figure 10). The anterior aspect of this dorsal face 19 is angled at around 29° in order to provide anchorage and stability with the bone interface. The anatomical tapered stem 20 enamates from the centre of the dorsal face 17 and is angled at 7° to the medial/lateral plane 21, which then determines the anatomical orientation of the implant. The bone interface (Figure 7) which is the entire surface of the implant in direct contact with the bone will be coated for either cemented or un-cemented use. The articular feature of this implant described with the numeral 15 will be surface engineered and surface treated

so as to minimise the friction coefficiency between this and its mating surface numeraled 22 and 23 in Figure 2. The articular geometry of 15 has been designed to promote the desired Dorsiflexion and Plantarflexion.

Referring to Figure 2, the sliding meniscus component has been designed with a complementary defined convex cylindrical articular geometry which will interface with the articular face 15 of the metatarsal implant shown in Figure 1. The articular face of the meniscus will also be designed with a complimentary defined convex cylindrical lateral stability groove 23, which will act together with the lateral stability rib 16 of Figure 1. Acting together they will provide a degree of stability and kinematic balance in the joint. Further this rib will be instrumental in transferring torsional loads between the metatarsal and the Phalanx by allowing the sliding meniscus to glide and rotate on faces marked 24 and 25. The surface of these features will be engineered so as to minimise the friction coefficiency between the faces 24 and 25 on the sliding meniscus (Figure 2), 26 and 27 of Figure 3, and their complementary mating surfaces of 15 and 16 in Figure 1, and 28 and 29 of Figure 4 which is part of the Phalangeal implant. These implants will be offered in two thicknesses 28 (Figure 2), in order to facilitate surgery and enhance natural joint soft tissue balance. This component will be capable of sliding in all planes i.e. medial, lateral, anterior, posterior and will also have the capacity of rotation. The tapered stem marked 25 will be housed in the tapered cavity 29 of the Phalangeal implant (Figure 4). When seen as in Figure 2(d) the sliding meniscus has a spherical or ovaloid profile.

Referring to Figure 4, the Phalangeal implant will have a tapered rectangular stem 30 to promote good fixation and resist residual torsional forces in the joint. Alternatively, the stem 30 may be a tapered conical arrangement. The surface of the tampered stem 30 and the dorsal part of the flange 31 both of which represent the bone interface element will be surface coated for use as either cemented or un-cemented prostheses. This is clearly illustrated in Figure 8. The profile of this component has been designed so as to preserve as much bone stock as is possible. The front face of the flange 128 together with the conical cavity 29 will be surface engineered and surface treated so as to minimise the friction between the mating faces of the sliding meniscus 24

and 25, (Figure 2). The spherical or ovaloid shape of the flange 33 has been designed to be low profile 32 and to stabilise the implant against the bone and to evenly transfer loads. Here again the ovaloid shape is designed to be bone preserving.

Preferred embodiments of the invention may have the following features:

1. Anatomical First Metatarsal and Phalangeal joints as illustrated in Figure 5, means a primary or revision total implant system comprising three individual implants working in unison to provide a fundamental range of motion such as but not limited to Dorsiflexion plantarflexion and residual rotation. The metatarsal implant is of an anatomic design and is offered in a range of four sizes in small, medium, large and x-large. The anatomic design of this component is meant to mimic the natural anatomic disposition of this joint and therefore, provides a flexible, compliant, ergonomic platform from which the sliding meniscus and the Phalangeal implant will contribute to the natural kinematics of the reconstructed joint. The design and attitude of the bone interface of the metatarsal implant is meant to be minimally bone sacrificing and could be implanted as either a press-fit or cemented device. The articular geometry and surface of this implant has been designed with a defined concave cylindrical lateral stabilising rib which is situated in the centre of the articular surface and on the centre-line of the articular arc. This defined concave cylindrical articular surface has been designed to offer Dorsiflexion, and plantarflexion and any rotation that is required for the efficacy and tribology of this articular couple. This is further illustrated in Figure 10. The articular surface of the metatarsal implant, Figure 1, 16 and 18 has been surface engineered to provide the lowest possible coefficient of friction between its surface and the complimentary articular surface of the sliding meniscus Figure 3/26 and 27.

2. The second element in the system is referred to as the sliding meniscus, Figured 2 and 3, which is non-anatomical and is offered in a range of two sizes namely small and medium and in two thicknesses 28 to

facilitate surgery and promote good kinematics and soft tissue balance. The defined convex cylindrical articular surface of the sliding meniscus has been designed with a defined convex cylindrical complimentary wear track and lateral stabilising groove/track which acts in unison with the complimentary features of the metatarsal component. The articular sliding and rotating surfaces of the sliding meniscus, Figure 2, parts 22, 23, 24 and 25 have been surface engineered to enhance the tribology of this wear couple. Here again, this component has been designed to contribute to the preservation of good original bone stock. The dorsal face 24 and conical stem of sliding meniscus 25 has been surface engineered to enhance tribology between this surface and the complimentary surfaces of the Phalangeal components. The intersect point between the stem and the dorsal face of the flange 38 has been designed with a smaller radius so as not to interfere with the top profile radius of the Phalangeal cavity 39. The wear couple surfaces of the sliding meniscus and the Phalangeal implant act together in a non-constrained environment and within the range of motion of the first metatarsal and Phalangeal joint. It is further perceived that this type of non-constrained wear couple has efficacy applications in other orthopaedic joints.

3. The third element in this system is referred to as the Phalangeal implant (Figure 4). The flange and ovaloid profile 32 and 33 of the Phalangeal implant has once again been designed to be bone preserving whilst yet providing a stable load bearing and transfer platform. A larger radius has been chosen for the profile between the cavity and the front face 39 so as not to contribute any shear forces. The dorsal face 31 and tapered rectangular stem 30 have been designed to provide stable, secure fixation within the phalanx whilst resisting any natural torsion forces acting through the natural kinematics of the joint. The bone interface surface of this implant (Figure 8) is offered with two surface treatments for use as either cemented or as a non-cemented device. The Phalangeal implant is non-anatomical and is offered in two sizes, small and medium and is meant to be of bone preserving designs.

4. The implant may incorporate the engineered "void" Figure 6, component 34 between the conical stem of the sliding meniscus and the conical cavity of the first Phalangeal implant.

5. The implant may incorporate the engineered "fit" Figure 6, component 35 between the dorsal surface of the sliding meniscus and its mating surface of the flange of the Phalangeal implant.

6. The implant may incorporate the engineered "void" Figure 5, component 36 between the lateral stability rib located in the articular surface of the first metatarsal implant and its mating surface of the track of the sliding meniscus.

7. The implant may incorporate the special engineered surface on the entire surface of the sliding meniscus (Figure 3 component) which has been developed to enhance tribology in this wear couple.

The reader's attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

Each feature disclosed in this specification (including any accompanying claims, abstract and drawings), may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

The invention is not restricted to the details of the foregoing embodiment(s). The invention extend to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

CLAIMS

1. An orthopaedic implant device for providing an orthopaedic joint, the device comprising a first component arranged to be secured relative to a proximal bone and a second component arranged to be secured relative to a distal bone, wherein the second component is arranged to rotate and be capable of translational movement relative to the first component.

2. A device according to Claim 1, wherein said first component includes first securement means comprising an elongate member having a first elongate axis for securing it into a proximal bone.

3. A device according to Claim 2, wherein said first component includes a first cooperation means which is a head part thereof for cooperation with the proximal bone within which it may be secured and/or for use in the provision of rotational and/or translational movement.

4. A device according to Claim 3, wherein said first cooperation means includes a curved surface for use in the provision of rotational and/or translational movement, wherein said surface curves through an angle of at least 30° and less than 210°.

5. A device according to Claim 4, wherein said first elongate axis defines an angle of at least 3° and less than 20° to a radius of said curved surface of said first component, when measured in the direction of the elongate extent of the curved surface.

6. A device according to Claim 3, Claim 4 or Claim 5, wherein said first securement means is immovably fixed relative to said first cooperation means.

7. A device according to any of Claims 3 to 6, wherein said first securement means extends from a rear face of said first cooperation means.

8. A device according to Claim 7, wherein said first securement means extends from a main dorsal face of said first cooperation means which main dorsal face is a part of said rear face and is defined on a chord of the curved surface of the first cooperation means.

9. A device according to Claim 8, wherein said chord subtends an angle of at least 40° and less than 100° at the centre of the curved surface of the first cooperation means.

10. A device according to Claim 8 or Claim 9, wherein the elongate axis of the first securement means extends substantially centrally from said main dorsal face.

11. A device according to any of Claims 8 to 10, wherein said rear face of said first cooperation means includes an anterior dorsal face which extends laterally to the main dorsal face.

12. A device according to any preceding claim, wherein said first component includes a first guide element which is a component of a guide means for guiding movement of the second component relative to the first component.

13. A device according to Claim 12, wherein said first component includes a projecting or recessed member arranged to cooperate with the other one of a projecting or recessed member fixed relative to the second component.

14. A device according to any preceding claim, wherein said second component includes second securement means for securement into a bone.

15. A device according to any preceding claim, wherein said second component includes a head part which extends laterally to an elongate axis of the second securement means.

16. A device according to any preceding claim, wherein said second component includes an opening for receiving an intermediate means which is arranged to connect the first and second components together.

17. A device according to Claim 16, wherein said intermediate means includes a male element for engagement in said opening in said second component.

18. A device according to Claim 17, wherein said male element and said opening are arranged such that, when engaged, said second component can move laterally relative to an elongate axis of the male element of the intermediate means.

19. A device according to any of Claims 16 to 18 wherein a face of said intermediate means makes face to face contact with a face of said second component.

20. A device according to Claim 19, wherein said respective faces which make face-to-face contact are substantially planar.

21. A device according to any of Claims 16 to 20, wherein said intermediate means includes a component of said guide means for guiding movement of the second component relative to the first component.

22. A device according to any of Claims 16 to 21, wherein said intermediate means makes face-to-face contact with a curved surface of said first component and said intermediate means has a complex curved surface which is substantially complimentary to that of said first component.

23. A device according to Claim 22, wherein said complex curved surface is substantially convex in profile when viewed along a guide means associated with said intermediate means, and said curved surface is concave when viewed in a direction which is perpendicular to the extent of said guide means.

24. A device according to any preceding claim, wherein said orthopaedic implant device includes five or fewer elements.

25. A device according to any preceding claim, wherein said device includes only three elements.

26. An assembly of an orthopaedic implant device, the device comprising a first component arranged to be secured relative to the proximal bone and a second component arranged to be secured relative to a distal bone, wherein the first and second components are operatively connected to one another so that the second component is rotatable and capable of translational movement relative to the first component.

27. A first component of an orthopaedic implant device as described in any of Claims 1 to 25 per se.

28. A second component of an orthopaedic implant device as described in any of Claims 1 to 25 per se.

29. An intermediate means of an orthopaedic implant device as described in any of Claims 1 to 25 per se.

30. A collocation comprising one or a plurality of first components, one or a plurality of second components and, optionally, one or a plurality of intermediate means each being as described in any of claims 1 to 24.

31. A method of providing an orthopaedic joint comprising securing a first component relative to a proximal bone and securing a second component relative to a distal bone, wherein the second component is arranged to rotate and be capable of translational movement relative to the first component.

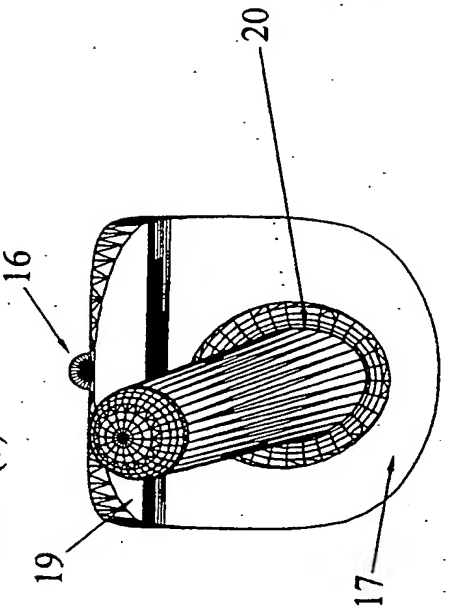


FIG 1 (b)

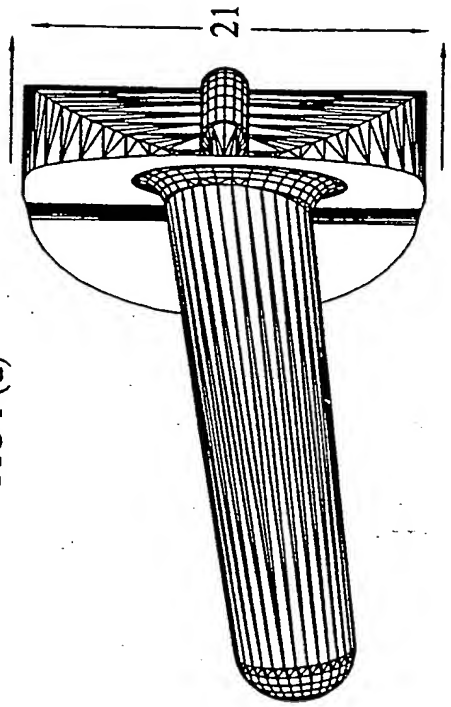


FIG 1 (d)

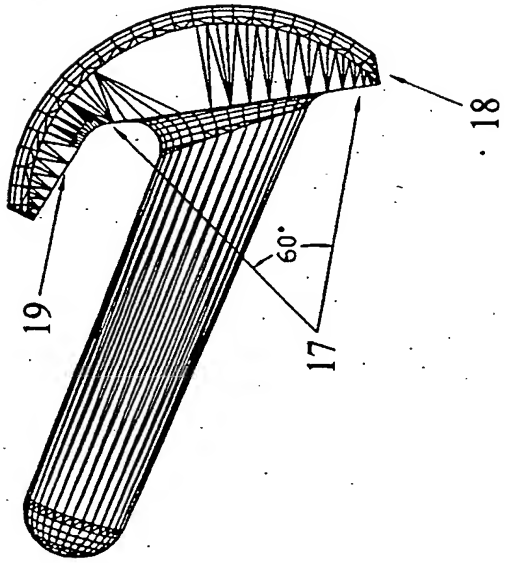


FIG 1 (a)

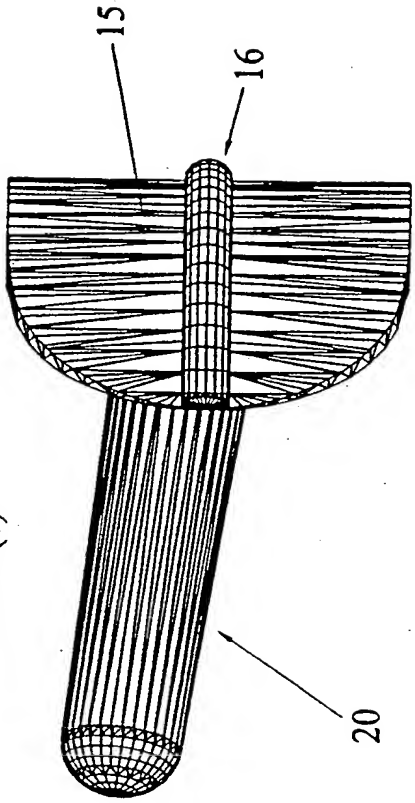


FIG 1 (c)

FIG 2 (b)

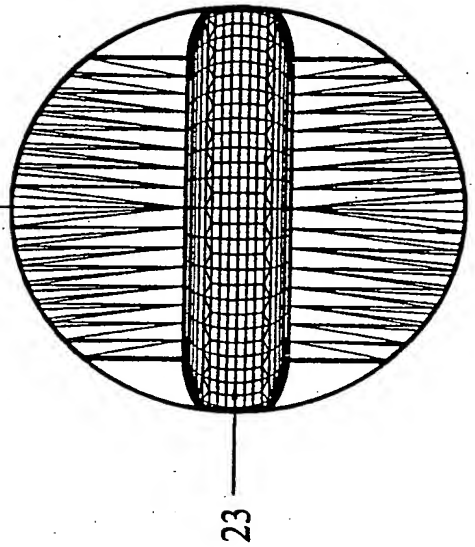


FIG 2 (d)

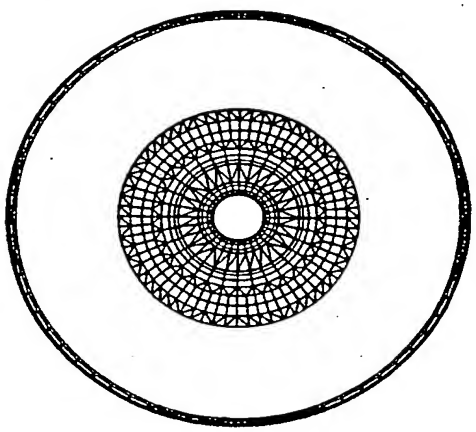


FIG 2 (a)

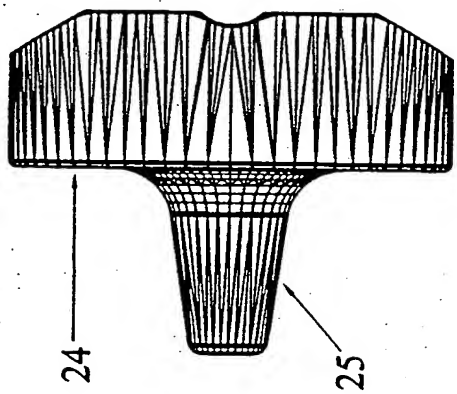


FIG 2 (c)

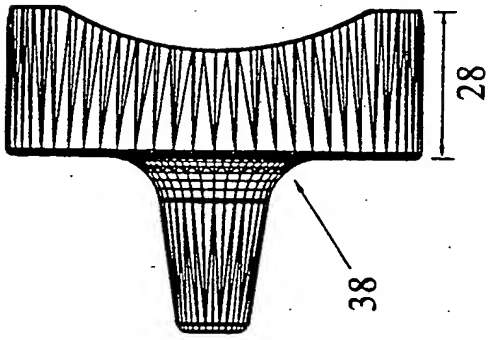
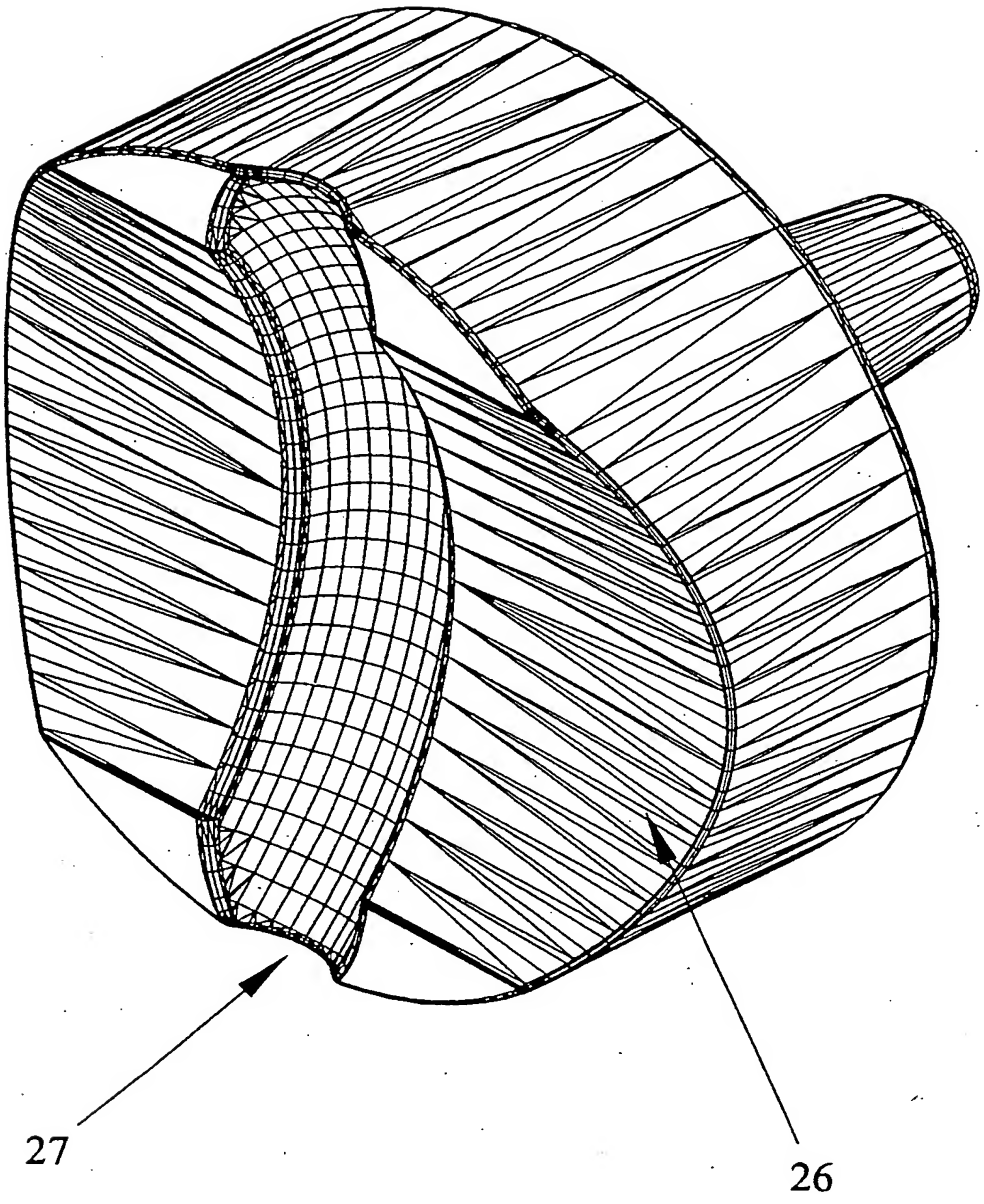


FIG 3



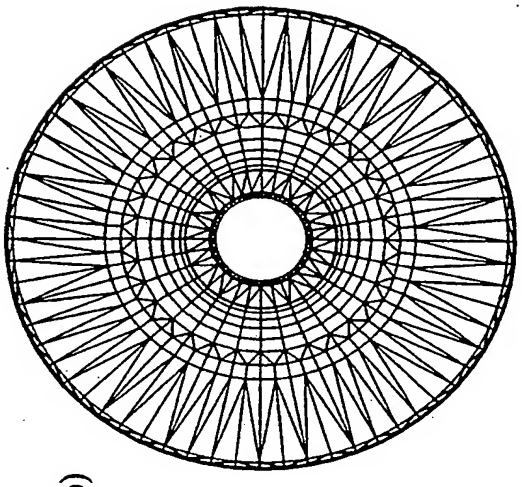


FIG 4 (b)

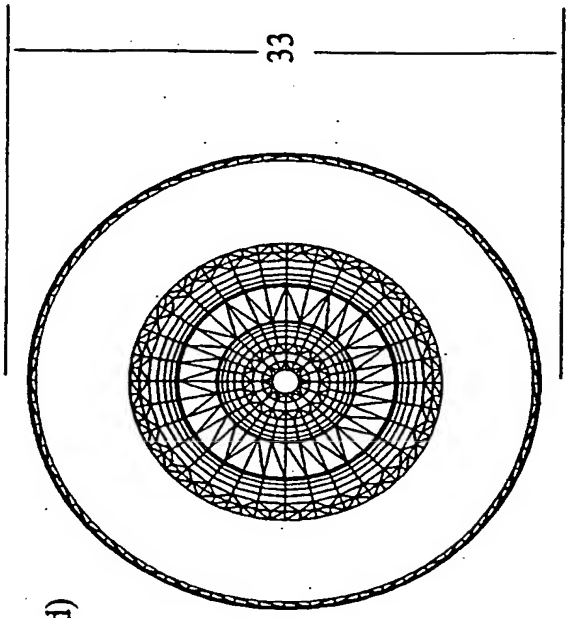


FIG 4 (d)

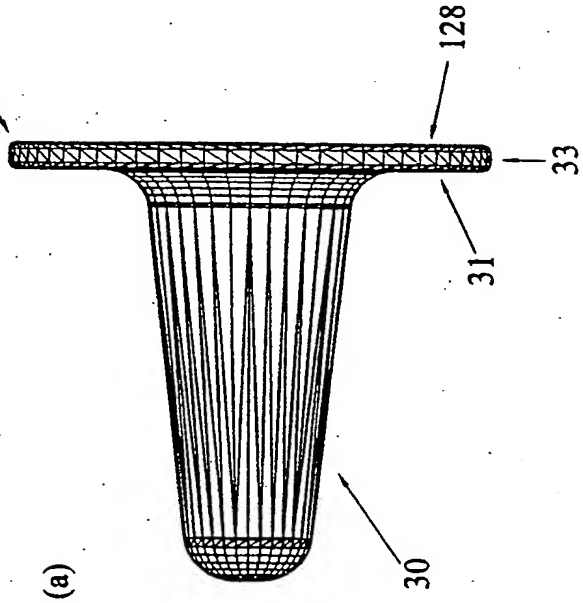


FIG 4 (a)

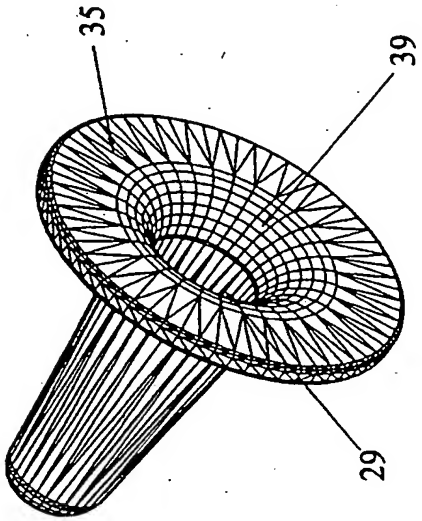
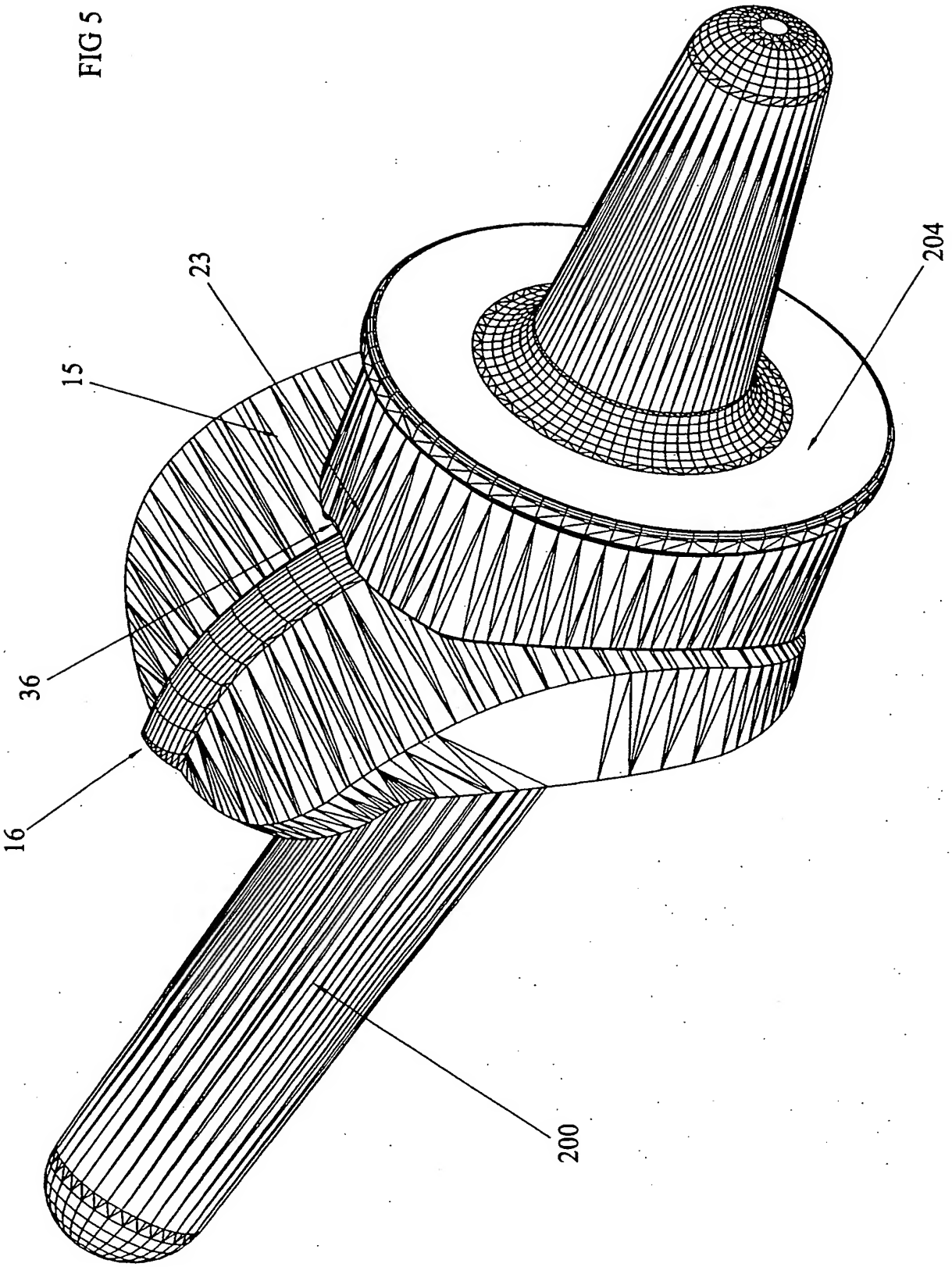


FIG 4 (c)

FIG 5



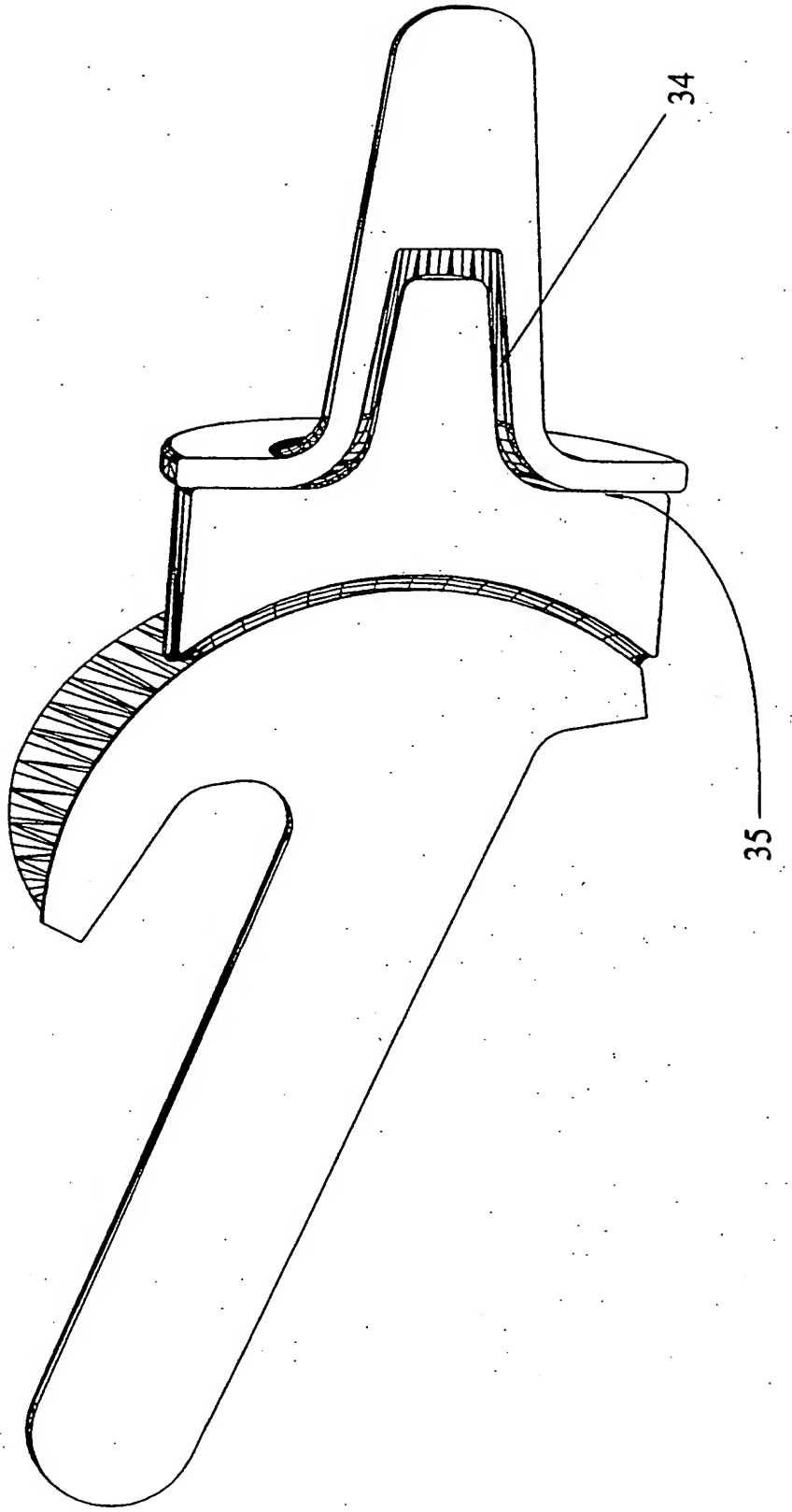


FIG 6

FIG 7

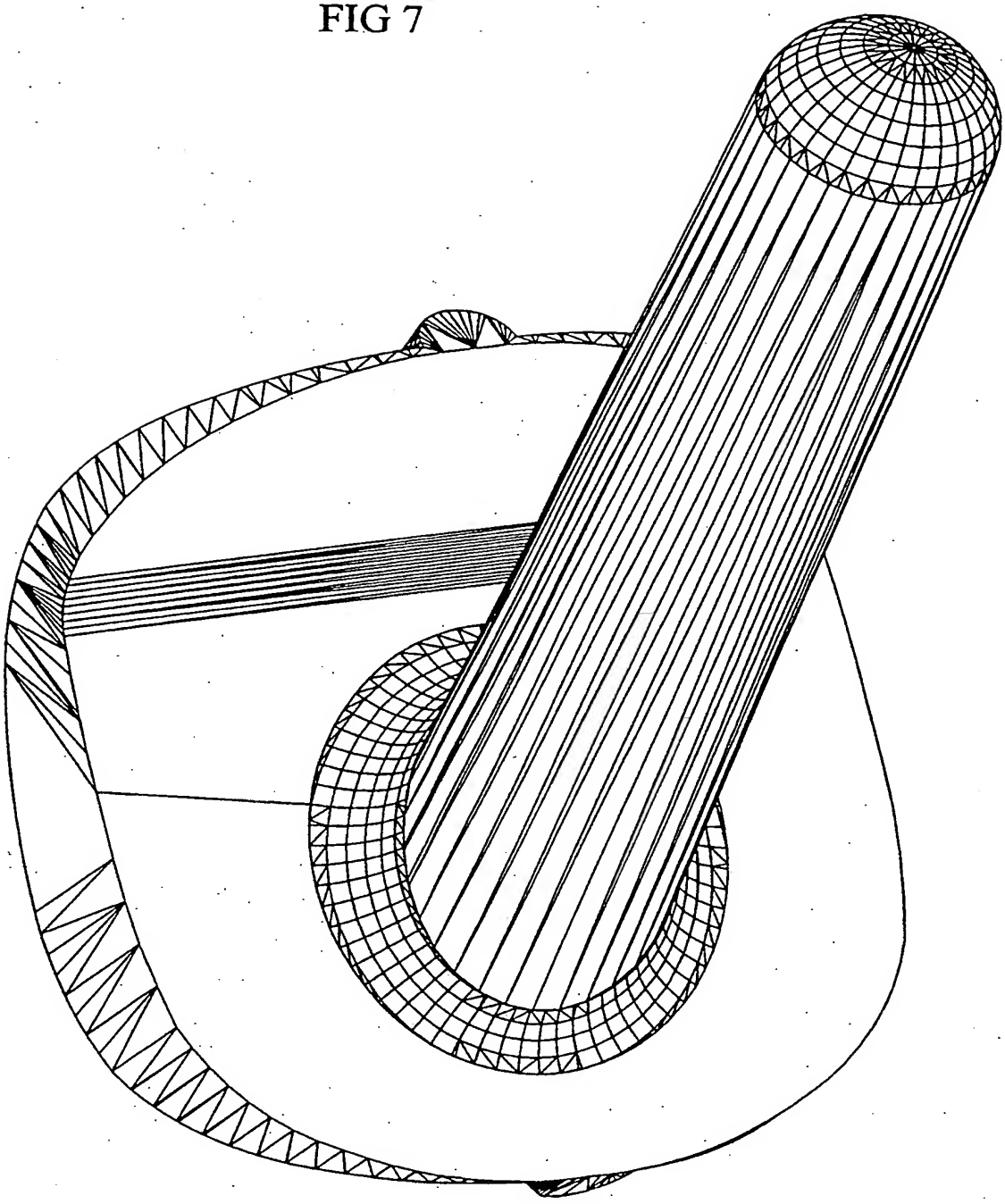


FIG 8

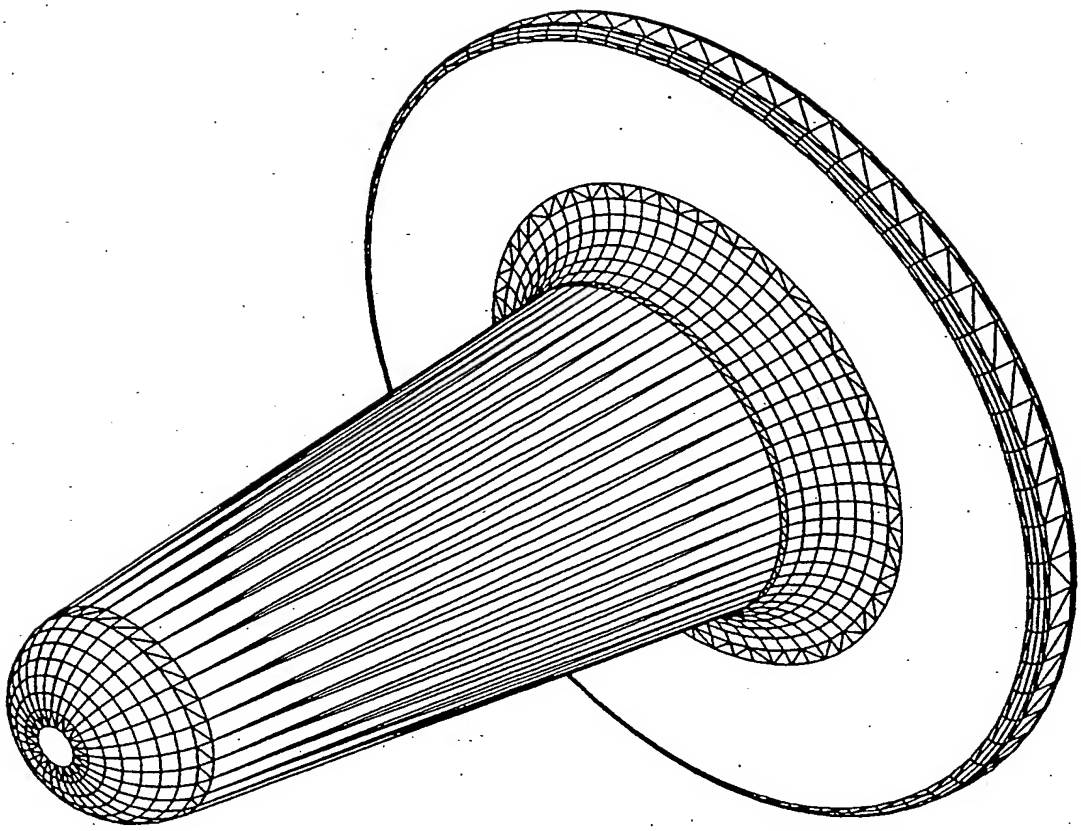


FIG 9 (a)

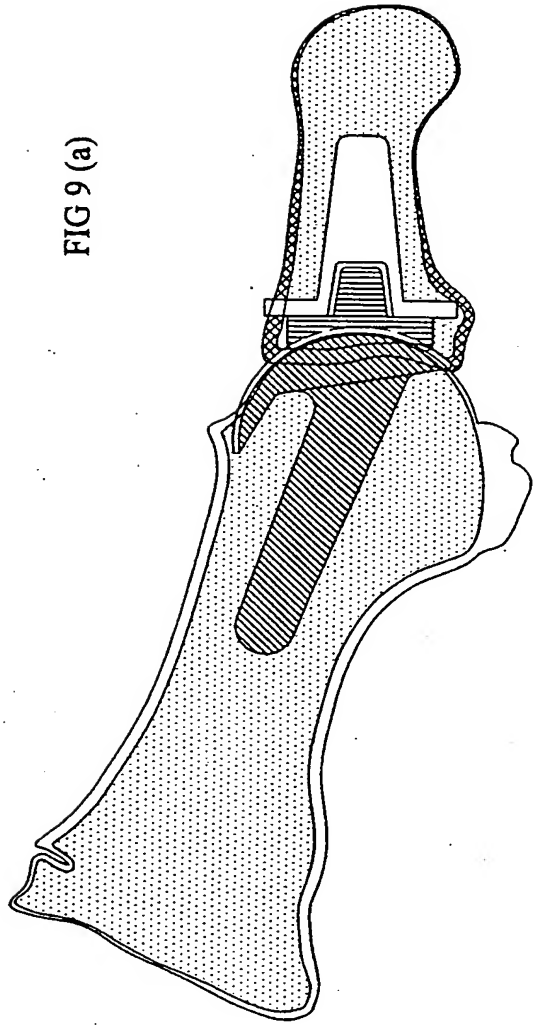


FIG 9 (b)

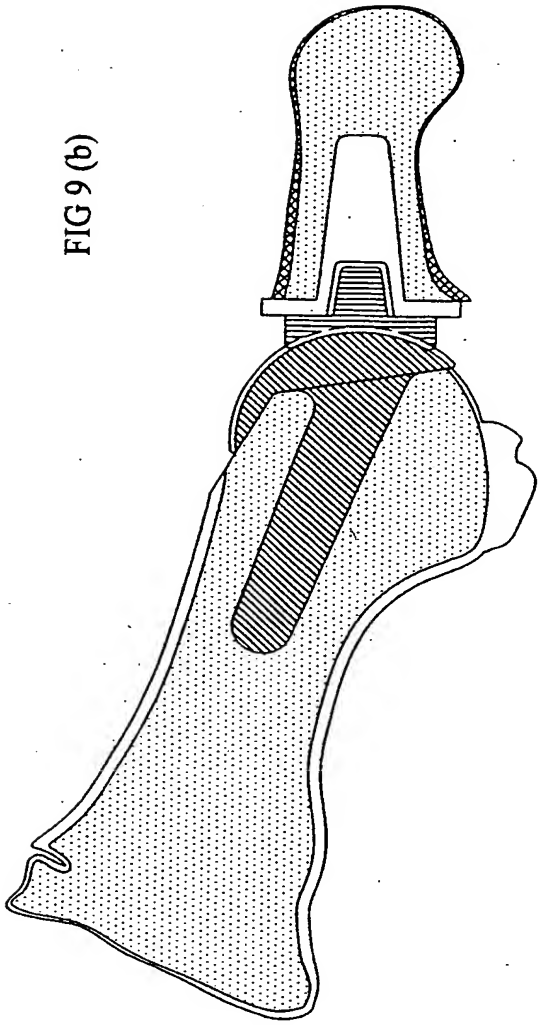


FIG 10 (a)

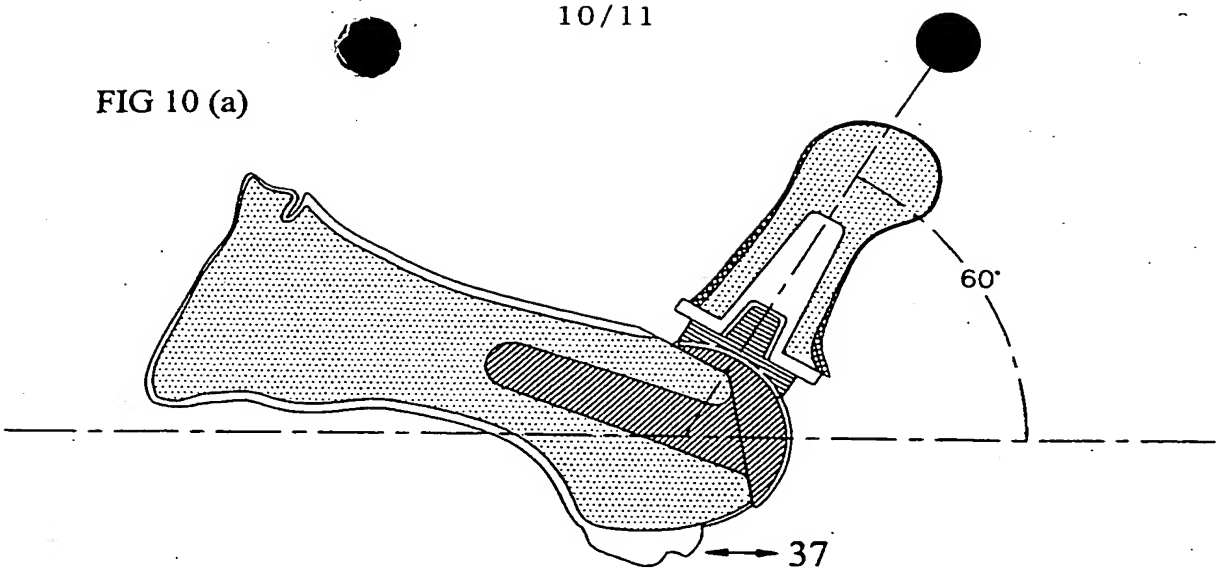


FIG 10 (b)

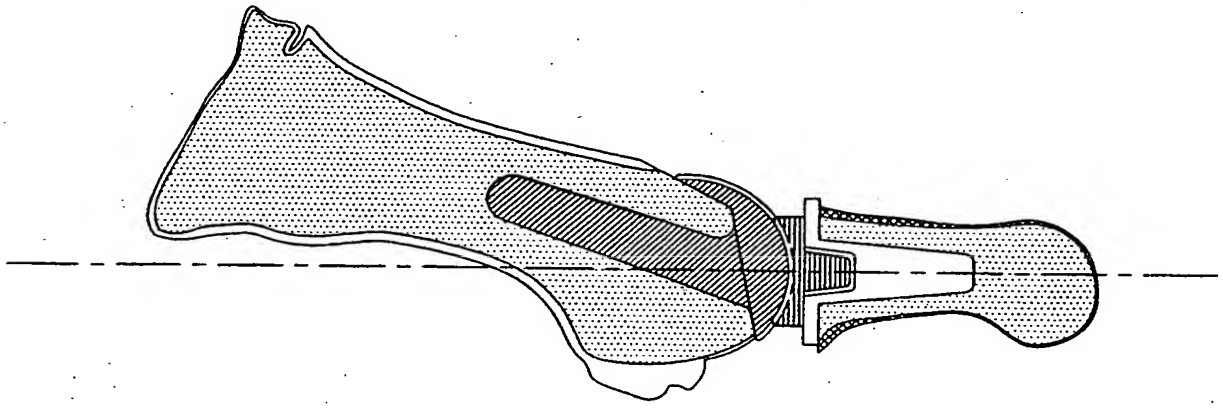
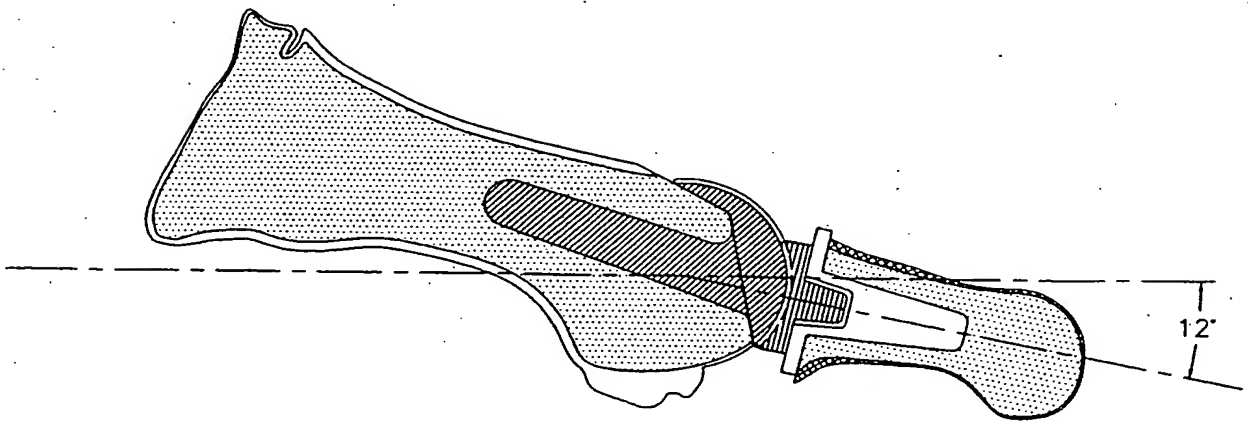


FIG 10 (c)



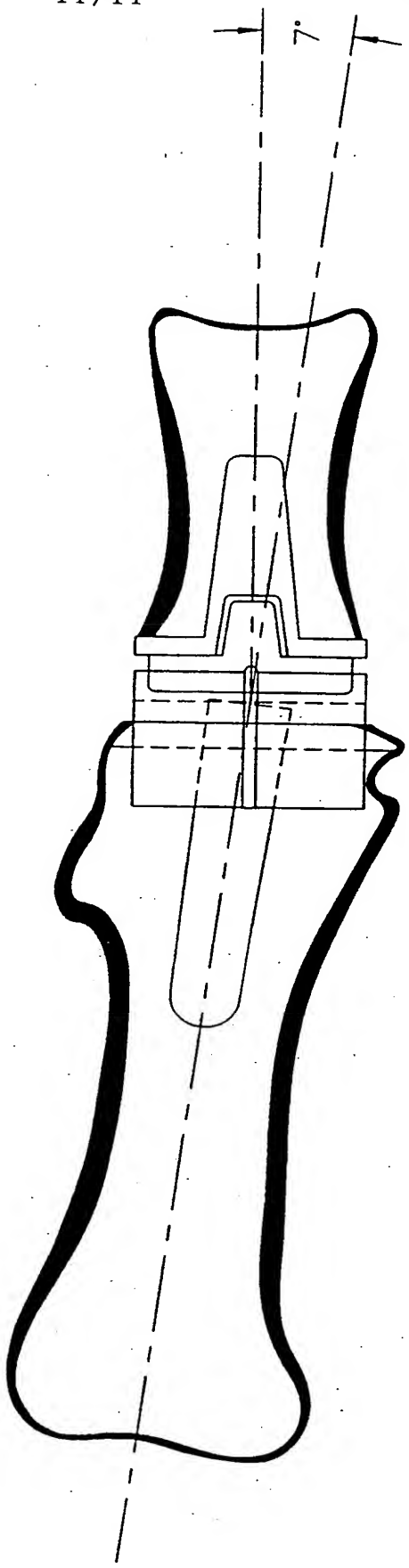


FIG 11

INTERNATIONAL SEARCH REPORT

Inte .ional Application No
PC /GB 00/02715

A. CLASSIFICATION OF SUBJECT MA
IPC 7 A61F2/42

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 658 342 A (DRAGANICH LOUIS F ET AL) 19 August 1997 (1997-08-19) claims; figures	1-9, 11-30
X	US 5 387 240 A (DRAGANICH LOUIS F ET AL) 7 February 1995 (1995-02-07) claims; figures	1-9, 11-30
A	WO 91 04718 A (NEOLIGAMENTS LTD) 18 April 1991 (1991-04-18) claims; figures	1-30
A	FR 2 734 150 A (SMITH AND NEPHEW RICHARDS SA) 22 November 1996 (1996-11-22) claims; figures	1-30

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
11 December 2000	21/12/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Kuehne, H-C

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INTERNATIONAL SEARCH REPORT

Int[redacted]ional Application No
PC[redacted]00/02715

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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A	US 5 674 297 A (LANE L B ET AL) 7 October 1997 (1997-10-07) column 4, line 53 -column 9, line 18 claims; figures	1-30
A	US 4 242 759 A (WHITE ROBERT C) 6 January 1981 (1981-01-06) claims; figures	1-30
A	FR 2 697 155 A (CEDIOR) 29 April 1994 (1994-04-29) claims; figures	1-30
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INTERNATIONAL SEARCH REPORT

Information on patent family members

Int[redacted]ional Application No
PCT[redacted] 00/02715

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